

NASA EEEE Parts Management – Overview & Status

Susana Douglas

NASA Electronic Parts Manager

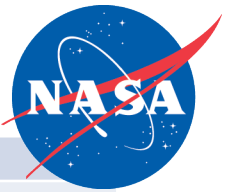
NASA Electronic Parts and Packaging (NEPP) Deputy Program Manager

NASA Goddard Space Flight Center

NEPP Electronics Technology Workshop (ETW)

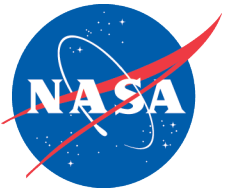
June 12, 2023

Acronyms

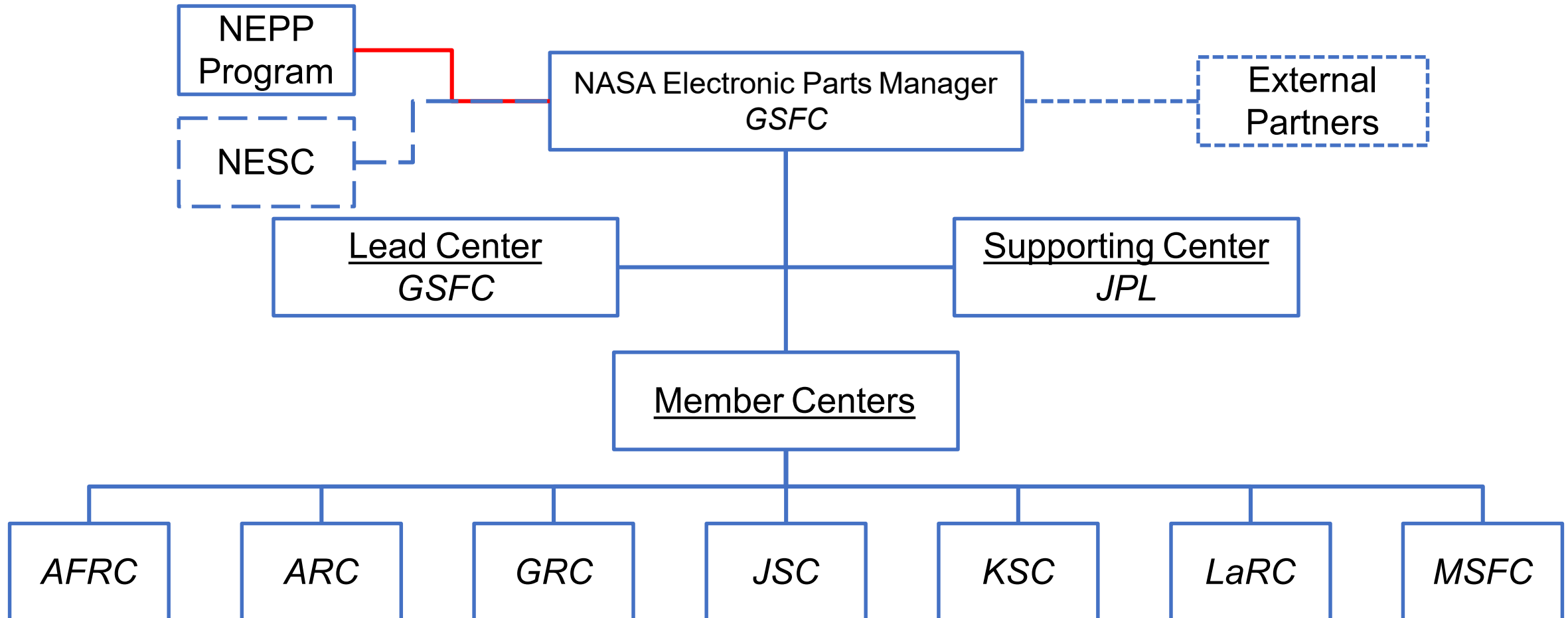


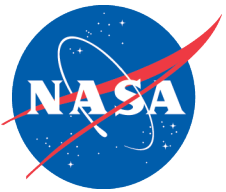
AFRC	Armstrong Flight Research Center	NEPAG	NASA Electronic Parts Assurance Group
AFRL	Air Force Research Laboratory	NEPP	NASA Electronic Parts & Packaging (Program)
ARC	Ames Research Center	NESC	NASA Engineering & Safety Center
BGA	Ball Grid Array	NPR	NASA Procedural Requirement
BNL	Brookhaven National Laboratory	NRL	Naval Research Laboratory
CARITL	Critical At-Risk Industrial Technology List	NSRL	NASA Space Radiation Laboratory
CPS	Candidate Protection Strategy	NVM	Non-Volatile Memory
DLA	Defense Logistics Agency	OCE	Office of Chief Engineer
DSBGA	Die-Size Ball Grid Array	OCIO	Office of Chief Information Officer
EEEE	Electrical, Electronic, Electromechanical, Electro-Optical	ODNI	Office of the Director of National Intelligence
ETW	Electronics Technology Workshop	OSMA	Office of Safety and Mission Assurance
DoD	Department of Defense	OUSD(R&E)	Office of the Under Secretary of Defense for Research and Engineering
DTRA	Defense Threat Reduction Agency	PSEP	Proactive Supplier Engagement Process
FPGA	Field-Programmable Gate Array	RaPID	(MDA) Radiation Parts Information Database
FRIB	Facility for Rare Isotope Beams	RHA	Radiation Hardness Assurance
GRC	Glenn Research Center	SCALE	Scalable Asymmetric Lifecycle Engagement
GSFC	Goddard Space Flight Center	SCIC	Supply Chain Insight Central
GWG	Government Working Group	SCRM	Supply Chain Risk Management
JEDEC	Joint Electron Device Engineering Council	SCRWG	Supply Chain Resiliency Working Group
JFAC	Joint Federated Assurance Center	SCS	Supply Chain Security
JPL	Jet Propulsion Laboratory	SEE	Single Event Effects
JSC	Johnson Space Center	SIBWG	Space Industrial Base Working Group
KSC	Kennedy Space Center	SRHEC	Strategic Radiation-Hardened Electronics Council
LaRC	Langley Research Center	STD	Standard
MDA	Missile Defense Agency	TAMU	Texas A&M University
MSFC	Marshall Space Flight Center	UMD	University of Maryland
MSU	Michigan State University	U.S.	United States (of America)
NASA	National Aeronautics and Space Administration	WBG	Wide Bandgap

NASA EEEE Parts Management



Manage and coordinate EEEE parts and radiation engineering capability and needs for the Agency





NASA EEEE Parts & Radiation Key Focuses

Parts Assurance

Standardization /
Best Practices for:

- COTS Utilization
- Radiation Testing
- Packaging Reliability
- Derating

Technology Development

- Wide Bandgap Reliability for Space
- Advanced Packaging / Photonic Integrated Circuits
- High-Performance Space Computing Ecosystem

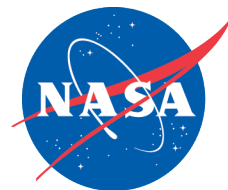
Facility & Tool Access

- NASA Block Buy through the Space Environments Testing Management Office
- Cross-Center Collaborative Work

Workforce Development

- Curriculum Development
- Hands-On Training
- Mentorship

NASA Standards & Guidelines Accomplishments



Published

Phase II of the NESC Recommendations on Use of COTS Electrical, Electronic, and Electromechanical (EEE) Parts for NASA Missions

<https://ntrs.nasa.gov/citations/20220018183>

NASA Guidelines for Ball Grid Array (BGA) and Die-Size BGA (DSBGA) Selection and Application

<https://nepp.nasa.gov/docs/tasks/076-Packaging-Assurance/Guidelines-BGA-DSBGA-Ghaffarian-2022July20-CL22-3574.pdf>

Guidelines for Screening, Lot Acceptance, and Derating of Polymer Tantalum Capacitors for Space Applications

<https://ntrs.nasa.gov/citations/20220019033>

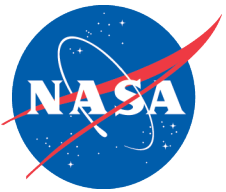
** Joint NRL-NASA Effort on the Defense Threat Reduction Agency (DTRA) Pulsed-Laser Single Event Effects (SEE) Test Guideline Handbook*

Coming Soon

NASA Radiation Hardness Assurance (RHA) Technical Standard

RHA for Photodetectors and Image Sensors Test Guideline

NASA-STD-8739.11 EEEE Parts Selection, Testing, and Derating Standard (preliminary draft released at request)



Leveraging Interagency Collaborations

Partners

Missile Defense Agency (MDA)

Strategic Radiation-Hardened Electronics Council (SRHEC)

Office of the Under Secretary of Defense for Research & Engineering Trusted and Assured Microelectronics (OUSD(R&E) T&AM) Program

U.S. Naval Research Laboratory (NRL)

Air Force Research Laboratory (AFRL)

Defense Logistics Agency (DLA)

Support for the Texas A&M University (TAMU) Bootcamp

EEEE parts radiation data sharing via SHREC Parts Library & MDA Radiation Parts Information Database (RaPID)
** support from Aerospace*

RHA evaluations for

- Field-Programmable Gate Arrays (FPGAs)
- Wide-Band Gap (WBG) Power Devices
- Non-Volatile Memory (NVM)

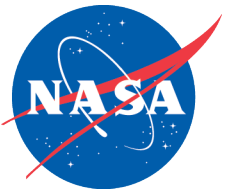
Pulsed-Laser SEE Testing Guidelines

Continued solutions to the heavy ion test facility shortage

- New MSU FRIB operational

Supply chain risk reduction

Workforce Development



Continuing to address aging workforce concerns in the field by providing new learning opportunities, mentorship, and hands-on training for entry-level parts and radiation engineers and university students, within NASA and via work with external cohorts

Parts Engineering

NASA EEE Parts 101*, hosted by MSFC onsite for NASA employees, virtual attendance open to U.S. partners

NEPP ETW training tutorials

MIL-SPEC training and new specification initiatives at various conferences and workshops*

NEPP Parts Engineering School*

Radiation Effects & Analysis

Rad101 short courses at various conferences and workshops*

Radiation Testing Hands-On Training*
➤ TAMU Bootcamp
➤ MDA Radiation Test Workshop at NSRL

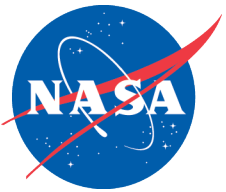
Single Event Effects University Seminars*, hosted by Stony Brook Univ./BNL, available online at <https://nanohub.org/>

UMD Satellite Design graduate course* (ENAE 691)

NASA employee course “Introduction to Radiation Assurance for SMA”

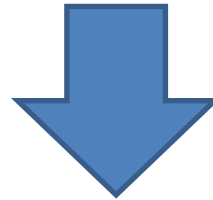
* Collaboration with external agencies and/or academia

Workforce Development



Continued support on university undergraduate opportunities:

- ❑ [Scalable Asymmetric Lifecycle Engagement \(SCALE\) program](#)
- ❑ National Security Innovation Network Hacking for Defense (NSIN H4D)



- Recent NASA subject matter expert mentorship of a student from Ohio State University on a tin whisker project, defined by MDA
- A team of 3 students worked to develop a Monte Carlo simulation software tool to estimate the risk of detached metal whiskers bridging exposed conductors on a printed wiring board

https://www.youtube.com/watch?v=fRpm3ihNgnQ*



Supply Chain Risk Management (SCRM)

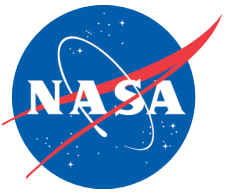
Volume 14, Issue 1, November 22, 2022

EEE Parts Supply Chain: Instability in the Pandemic Global Space Parts Industry

With the introduction of COVID-19, the EEE space component industry has seen consequential changes to its supply chain, including its labor workforce, labor practices, shipping, distribution, and sourcing of raw materials. The safety limitations of in-person work have led to a labor shortage in manufacturing facilities, as well as a shortage of on-the-job training, resulting in a deficit of trained personnel and a trend of factories shutting down. Safety limitations have also saturated and deferred the existing distribution channels, affecting electronics suppliers and their inventory storages. Additionally, global political and economic conflicts have added obstacles to the sourcing of raw materials. These changes, along with the introduction of new technologies, have introduced a need for new approaches towards supply chain reliability and scheduling assessment. In this bulletin we will explore the results of these current industry changes on the EEE space component supply chain, through assessing and comparing the lead times of commonly purchased components in the space electronics industry. We will also identify risk reduction methods to ensure a stable EEE component supply chain.

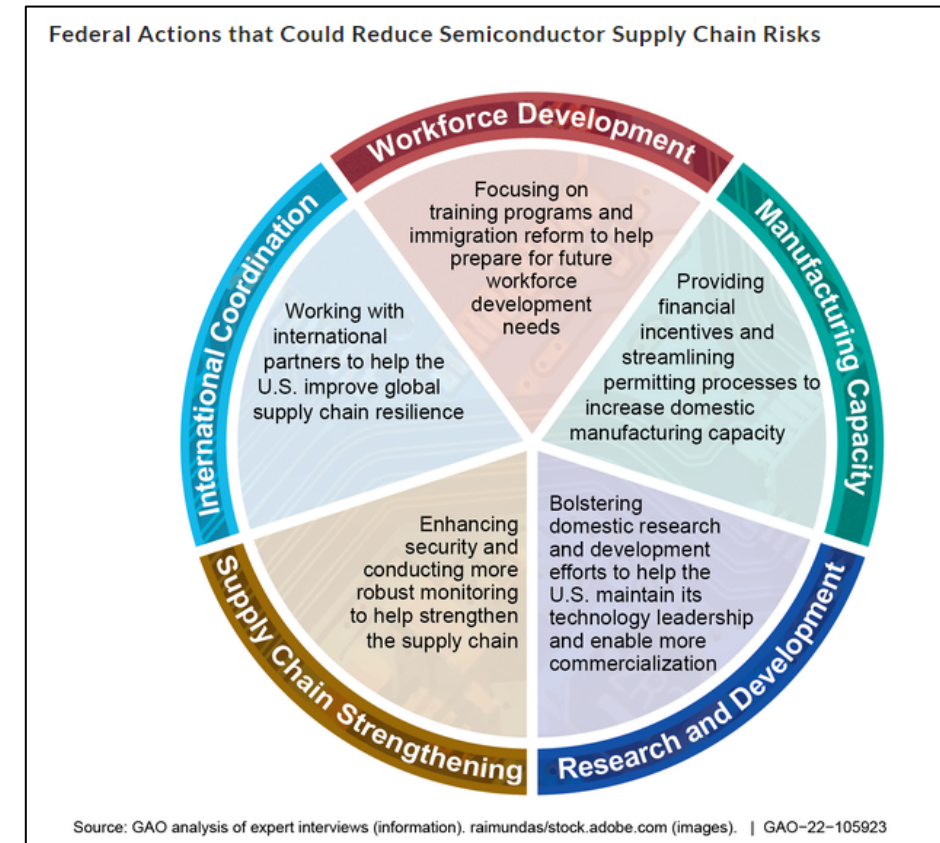
NASA EEE Parts Bulletin released last year to emphasize the prolonged strain on the supply chain and highlight the need for continuous monitoring of parts and material sources of supply for risk reduction to our programs:

https://sma.nasa.gov/docs/default-source/news-documents/eee-parts-supply-chain-instability-in-the-pandemic-global-space-parts-industry-1.pdf?sfvrsn=a301cff8_0

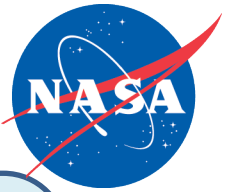


Supply Chain Risk Reduction Efforts

- Continuously track and report EEEE parts and materials supply chain impacts for whole of government solutions at key forums
 - ❑ NASA Electronic Parts Assurance Group (NEPAG) weekly telecons
 - ❑ NEPAG Government Working Group (GWG) bi-weekly meetings
 - ❑ JEDEC semi-annual meetings
 - ❑ Bi-annual Center Parts Management meetings
- Engage with the Space Industrial Base Working Group (SIBWG) for critical concerns
- Leverage manufacturer/vendor relationships and government/industry partners for mitigation of supply chain constraints



NASA Supply Chain Security (SCS) Efforts



Engagement with External Agencies

Joint-Federated Assurance Center (JFAC)
DoD Microelectronics / OUSD(R&E)
Office of the Director of National Intelligence (ODNI)
Pacific Northwest National Labs / Space Force Space Systems Command
Aerospace Corporation

Supplier Briefings on NASA SCRM Proactive Supplier Engagement Process (PSEP) Submissions

Analog Devices, Inc.

Renesas/Intersil

Supply Chain Security Working Group (SCSWG)

Kanitra Tyler, OCIO, Chair

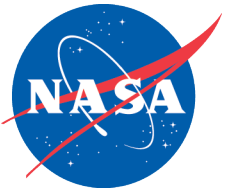
Susana Douglas, EEEE Parts, Executive Chair

Discussions on Internal NASA SCRM Activities

Candidate Protection Strategy (CPS) for Supply Chain and Best Practices [NASA-STD-1006A, NPR 1058.1]

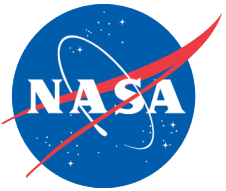
OSMA SCRM on Project Protection Plan [NPR 7120.5]

NASA SCRM Integration

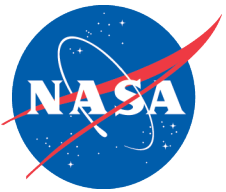


- Newly formed Supply Chain Resiliency Working Group (SCRWG)
 - Led by Associate Administrator for Space Security Interests, Tom Cremins
 - Provides a combined forum for all NASA SCS/SCRM working groups for an integrated approach
- OSMA SCRM program tracking and managing supply chain issues at the agency level
 - Supply Chain Insight Central (SCIC) platform tool
 - SCIC module for Critical At-Risk Industrial Technology List (CARITL) management, developed by the Office of the Chief Engineer (OCE)

U.S. Legislation Driving Forces in EEEE Parts



- [The CHIPS and Science Act](#) is providing major incentives to develop on-shore semiconductor manufacturing and research, and strengthen the security of the American supply chain
- Additional supply chain security drivers for U.S. government systems:
 - ❑ [National Defense Authorization Act for Fiscal Year 2020 \(Public Law 116-92\)](#)
 - ❑ [Executive Order 14017: America's Supply Chain](#)
 - ❑ [Executive Order 14028: Improving the Nation's Cybersecurity](#)



Summary

- Continue to establish processes and infrastructure to address the needs of the space parts and radiation engineering community through cooperative work both among NASA internal stakeholders and our external partners
 - Interagency collaborations and sharing of knowledge and tools for sustainment and growth in the areas of
 - supply chain risk management and risk reduction efforts
 - new technology development and qualification activities
 - radiation test facility increased access
 - workforce development
 - Consolidate efforts when feasible and appropriate